

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A method of forming a metal-containing film on a substrate, the method comprising:

providing a plurality of substrates on respective surfaces of a tier substrate holder in a process chamber of a batch type processing system;

heating the substrates to a ~~predetermined temperature where film deposition rate is independent of temperature~~ of approximately 180°C;

flowing a pulse of a ~~metal~~hafnium-containing precursor in the process chamber;

flowing a pulse of a reactant gas in the process chamber; and

repeating the flowing processes until a ~~metal~~hafnium-containing film with desired film properties is formed on the substrates.

Claim 2 (Canceled).

Claim 3 (Currently Amended): The method according to claim 1, wherein the repeating comprises forming ~~at least one of a HfO₂ film, a ZrO₂ film, and a film containing a mixture of~~ comprising HfO₂ and ZrO₂.

Claim 4 (Original): The method according to claim 1, further comprising flowing a purge gas in the process chamber.

Claim 5 (Original): The method according to claim 4, wherein the flowing a purge gas comprises flowing a flow rate between about 100sccm and about 10,000sccm.

Claim 6 (Original): The method according to claim 1, further comprising flowing a pulse of a purge gas in the process chamber when the metal-containing precursor and the reactant gas are not flowing.

Claim 7 (Original): The method according to claim 6, wherein the flowing a pulse of a purge gas comprises flowing a pulse duration between about 1sec to about 500sec.

Claim 8 (Currently Amended): The method according to claim 1, wherein the flowing a pulse of a ~~metal~~ hafnium-containing precursor comprises flowing a ~~metal~~ hafnium-containing precursor and a carrier gas.

Claim 9 (Original): The method according to claim 8, wherein the flowing a carrier gas comprises a flow rate between about 100sccm and about 10,000sccm.

Claim 10 (Original): The method according to claim 1, wherein the flowing a pulse of a reactant gas comprises flowing a reactant gas and a carrier gas.

Claim 11 (Original): The method according to claim 1, wherein the flowing a pulse of a reactant gas comprises flowing at least one of an oxidizing gas, a reducing gas, and an inert gas.

Claim 12 (Original): The method according to claim 11, wherein the flowing a pulse of an oxidizing gas comprises flowing an oxygen-containing gas.

Claim 13 (Original): The method according to claim 12, wherein the flowing a pulse of an oxygen-containing gas comprises flowing at least one of O₂, O₃, H₂O₂, H₂O, NO, N₂O, and NO₂.

Claim 14 (Withdrawn): The method according to claim 11, wherein the flowing a pulse of a reducing gas comprises flowing at least one of a hydrogen-containing gas, a silicon-containing gas, a boron-containing gas, and a nitrogen-containing gas.

Claim 15 (Withdrawn): The method according to claim 14, wherein the flowing a pulse of a hydrogen-containing gas comprises flowing H₂.

Claim 16 (Withdrawn): The method according to claim 14, wherein the flowing a pulse of a silicon-containing gas comprises flowing at least one of SiH₄, Si₂H₆, Si₂Cl₆, and SiCl₂H₂.

Claim 17 (Withdrawn): The method according to claim 14, wherein the flowing a pulse of a boron-containing gas comprises flowing a gas with the formula B_xH_{3x}.

Claim 18 (Withdrawn): The method according to claim 14, wherein the flowing a pulse of a the boron-containing gas comprises flowing at least one of BH₃, B₂H₆, and B₃H₉.

Claim 19 (Withdrawn): The method according to claim 14, wherein the flowing a pulse of a nitrogen-containing gas comprises flowing NH₃.

Claim 20 (Original): The method according to claim 1, wherein the providing comprises providing at least one of a semiconductor substrate, a LCD substrate, and a glass substrate.

Claim 21 (Original): The method according to claim 20, wherein the providing comprises providing a Si substrate or a compound semiconductor substrate.

Claim 22 (Original): The method according to claim 1, wherein the providing comprises providing a substrate containing an interfacial film selected from an oxide film, a nitride film, an oxynitride film, or mixtures thereof.

Claim 23 (Original): The method according to claim 1, wherein the providing comprises providing a batch of about 100 substrates or less.

Claim 24 (Original): The method according to claim 1, wherein the providing comprises providing a substrate with a substrate diameter greater than about 195 mm.

Claim 25 (Currently Amended): The method according to claim 1, wherein the flowing a pulse of a ~~metal~~ hafnium-containing precursor comprises flowing a pulse duration between about 1sec and about 500sec.

Claim 26 (Original): The method according to claim 1, wherein the flowing a pulse of a reactant gas comprises flowing a pulse duration between about 1sec and about 500sec.

Claims 27-28 (Canceled).

Claim 29 (Currently Amended): The method according to claim 1, wherein the flowing a pulse of a ~~metal~~ hafnium-containing precursor further comprises flowing a ~~metal~~ hafnium-containing precursor liquid into a vaporizer at a flow rate between about 0.05ccm and about 1ccm.

Claim 30 (Original): The method according to claim 1, wherein the flowing a pulse of a reactant gas comprises flowing a flow rate between about 100sccm and about 2,000sccm.

Claim 31 (Original): The method according to claim 1, further comprising providing a process chamber pressure less than about 10Torr.

Claim 32 (Original): The method according to claim 1, further comprising providing a process chamber pressure between about 0.05Torr and about 2Torr.

Claim 33 (Original): The method according to claim 1, further comprising providing a process chamber pressure of about 0.3Torr.

Claim 34 (Currently Amended): The method according to claim 1, wherein the repeating comprises forming a ~~metal~~ hafnium-containing film with a film thickness less than about 1000A.

Claim 35 (Currently Amended): The method according to claim 1, wherein the repeating comprises forming a ~~metal~~ hafnium-containing film with a film thickness less than about 200A.

Claim 36 (Currently Amended): The method according to claim 1, wherein the repeating comprises forming a ~~metal~~ hafnium-containing film with a film thickness less than about 50Å.

Claim 37 (Currently Amended): The method according to claim 1, further comprising annealing the ~~metal~~ hafnium-containing film at a temperature between about 150°C and about 1000°C.

Claim 38 (Original): The method according to claim 1, further comprising depositing an electrode film comprising at least one of W, Al, TaN, TaSiN, HfN, HfSiN, TiN, TiSiN, Re, Ru, Si, poly-Si, and SiGe.

Claim 39 (Withdrawn): The method according to claim 1, further comprising flowing a pulse of a nitrogen-containing gas in the process chamber.

Claim 40 (Canceled).

Claim 41 (Withdrawn/Currently Amended): The method according to claim 39, wherein the repeating comprises forming ~~at least one of a $\text{Hf}_x\text{O}_z\text{N}_w$ film, a $\text{Zr}_x\text{O}_z\text{N}_w$ film, and~~ a film ~~containing a mixture of~~ comprising $\text{Hf}_x\text{O}_z\text{N}_w$ and $\text{Zr}_x\text{O}_z\text{N}_w$.

Claim 42 (Withdrawn/Currently Amended): The method according to claim 39, wherein:

the flowing a pulse of a ~~metal~~ hafnium-containing precursor comprises flowing at least one pulse,

the flowing a pulse of a reactant gas comprises flowing at least one pulse, and
the flowing a pulse of a nitrogen-containing gas comprises at least one pulse.

Claim 43 (Withdrawn): The method according to claim 1, further comprising flowing a pulse of a silicon-containing gas in the process chamber.

Claim 44 (Canceled).

Claim 45 (Withdrawn/Currently Amended): The method according to claim 43, wherein the repeating comprises forming ~~at least one of a $\text{Hf}_x\text{Si}_y\text{O}_z$ film, a $\text{Zr}_x\text{Si}_y\text{O}_z$ film, and a film containing a mixture of comprising $\text{Hf}_x\text{Si}_y\text{O}_z$ and $\text{Zr}_x\text{Si}_y\text{O}_z$.~~

Claim 46 (Withdrawn/Currently Amended): The method according to claim 43, wherein:

the flowing a pulse of a ~~metal~~ hafnium-containing precursor comprises flowing at least one pulse,

the flowing a pulse of a reactant gas comprises flowing at least one pulse, and
the flowing a pulse of a silicon-containing gas comprises at least one pulse.

Claim 47 (Withdrawn): The method according to claim 43, further comprising flowing a pulse of nitrogen-containing gas in the process chamber

Claim 48 (Withdrawn): The method according to claim 47, wherein the repeating comprises forming a nitrogen-containing metal-silicate film.

Claim 49 (Withdrawn/Currently Amended): The method according to claim 47, wherein the repeating comprises forming ~~at least one of a $\text{Hf}_x\text{Si}_y\text{O}_z\text{N}_w$ film, a $\text{Zr}_x\text{Si}_y\text{O}_z\text{N}_w$ film, and a film containing a mixture of comprising $\text{Hf}_x\text{Si}_y\text{O}_z\text{N}_w$ and $\text{Zr}_x\text{Si}_y\text{O}_z\text{N}_w$.~~

Claim 50 (Withdrawn/Currently Amended): The method according to claim 47, wherein:

the flowing a pulse of a metal hafnium-containing precursor comprises flowing at least one pulse,

the flowing a pulse of a reactant gas comprises flowing at least one pulse,

the flowing a pulse of a nitrogen-containing gas comprises at least one pulse, and

the flowing a pulse of a silicon-containing gas comprises at least one pulse.

Claim 51 (Canceled).

Claim 52 (Currently Amended): The method according to claim 1, wherein the heating comprises heating the ~~substrate~~ plurality of substrates under isothermal heating conditions.

Claim 53 (Canceled).

Claim 54 (Canceled).

Claim 55 (Withdrawn/Currently Amended): The method according to claim 1 ~~53~~, wherein the flowing a pulse of hafnium-containing precursor ~~metal alkoxide~~ comprises flowing ~~at least one of a hafnium alkoxide and a zirconium alkoxide~~.

Claim 56 (Withdrawn/Currently Amended): The method according to claim 55 ~~53~~, wherein the flowing a ~~metal~~ hafnium alkoxide comprises flowing ~~at least one of Hf(OBut)₄ and Zr(OBut)₄~~.

Claim 57 (Canceled).

Claim 58 (Canceled).

Claim 59 (Currently Amended): The method according to claim 1 ~~58~~, wherein the flowing a pulse of hafnium-containing precursor ~~metal alkylamide~~ comprises flowing ~~at least one of a hafnium alkylamide and a zirconium alkylamide~~.

Claim 60 (Currently Amended): The method according to claim 59 ~~58~~, wherein the flowing a ~~metal~~ hafnium alkylamide comprises flowing at least one of Hf(NEt₂)₄, Hf(NEtMe)₄, or a combination thereof, ~~Zr(NEt₂)₄ and Zr(NEtMe)₄~~.

Claim 61 (Previously Presented): The method according to claim 1, wherein:
the repeating comprises forming an HfO₂ film on each of the plurality of substrates, each film having a thickness of about 30Å to about 50Å and a WIW uniformity of about 10% to about 15%.

Claim 62 (Previously Presented): The method according to claim 1, wherein:
the repeating comprises forming an HfO_2 film on each of the plurality of substrates,
each film having a thickness of about 20A to about 50A and a WIW uniformity of about 20%
or less.

Claims 63-64 (Canceled).

Claim 65 (Withdrawn): A computer readable medium containing program
instructions for execution on a processor, which when executed by the processor, cause a
batch substrate processing apparatus to perform the steps in the method recited in claim 1.

Claims 66-77 (Canceled).

Claim 78 (Previously Presented): The method of Claim 1, wherein said flowing steps
provide a deposition rate of about 1 angstrom per cycle.

Claim 79 (New): A method of forming a metal-containing film on a substrate, the
method comprising:

providing a plurality of substrates on respective surfaces of a tier substrate holder in a
process chamber of a batch type processing system;

heating the substrates;

flowing a pulse of hafnium-containing precursor in the process chamber; and

flowing a pulse of a reactant gas in the process chamber, wherein a total time of a
cycle of flowing a pulse of hafnium-containing precursor and flowing pulse of reactant gas in
the process chamber is less than 30 seconds and is repeated less than 20 times.

Claim 80 (New): The method of claim 79, wherein said heating comprises heating the substrates to approximately 200°C at a chamber pressure of approximately .3 Torr.

Claim 81 (New): A method of forming a metal containing film on a substrate, the method comprising:

providing a plurality of substrates on respective surfaces of a tier substrate holder in a process chamber of a batch type processing system, said substrates being placed only from a middle surface to a lower surface of the tier substrate holder;

heating the substrates;

flowing a pulse of a hafnium-containing precursor in the process chamber;

flowing a pulse of a reactant gas in the process chamber; and

repeating the flowing process until a metal containing film with desired film properties is formed on the substrates.

Claim 82 (New): The method of claim 81, wherein said providing comprises providing the plurality of substrates on a bottom 50 respective surfaces of a 100 substrate capacity tier substrate holder.